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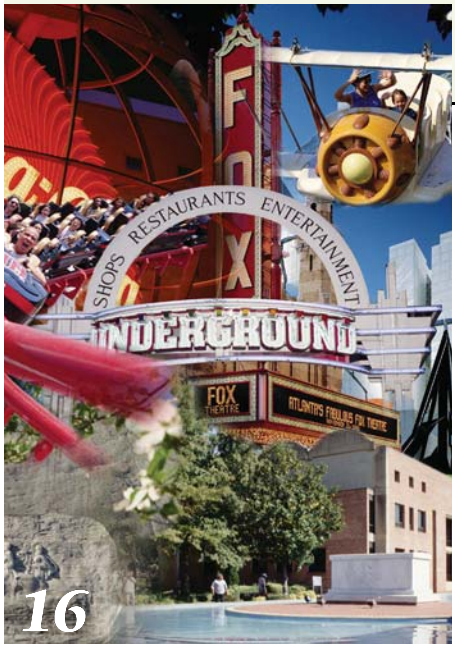

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COVER PHOTO

Stone Mountain, Georgia USA is the site of an INTERTECH 2006 evening event with paddle wheel boat dinner cruise, laser light show and fireworks. Stone Mountain is solid granite and has the Largest High-Relief Sculpture in the World. Quarrying took place at the mountain for 130 years and was shipped throughout the world. An estimated 7.5 million cubic feet of granite were removed from the mountain.

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A Finer Point of View…

Disaster and challenges bring out the best in mankind.

Just four years, ago September 11, 2001, the United States was caught up in one of the most horrific acts ever unleashed against an unsuspecting country. The premeditated and ruthless attacks leveled against innocent people in New York, Virginia and Pennsylvania will forever stand as one of the most hateful crimes ever spawned by sick minds. It would give us some comfort to think of these people as insane, but it is even more frightful to think that this is a programmed response to a lifetime of hateful teachings. But hate and aggression from the worst of mankind was overshadowed by the best of mankind. Around the world candles were lighted, American songs were sung in every language and for a brief moment in time all the good people in the world stood up to be counted. I remember a Canadian singing God Bless America, a German schoolgirl singing a beautiful National Anthem and a Russian band playing patriotic American tunes. The candlelight services and memorials rose above the feeble attempt to scare and intimidate free people. Heroes arose from smoke, fire and ash. Death was everywhere and everyday heroes carried out the wounded and risked their own lives, even to the greatest sacrifice, giving their own. There is a famous passage that reads: "Greater love hath no man than this, that a man lay down his life for his friends." How much greater must that love of mankind be to lay down your life for a stranger!

This September, in the aftermath of hurricane Katrina, we see a different form of destruction but more of the same courage and selfless sacrifice… individuals risking their own lives to go to the aid of people trapped, starving and helpless. This storm was an act of nature, but the result was even more devastating with a wider reach that directly affects millions. While the big picture of rebuilding and aid goes to Federal and Local agencies, the vast support and aid from everyday citizens is heartwarming… these people are the extended heroes of the Katrina relief.

PRESIDENT
Joseph Tabeling

Everywhere children and local communities reacted swiftly and with conviction to help people they didn't know. This says a lot for the average person. We will always see those who would use the misfortune of others to profit for themselves. Price gouging and looting is the dark side of any tragedy. To say these people should be ashamed of themselves is useless, that kind of person has no shame. Gratefully, these people are few in comparison, far outweighed by the overwhelming legions of volunteers and contributors to the relief effort.

The events of 911 had negative impact on the financial world and now Katrina will affect all of us in much the same way. Gas prices have soared and this winter will find us dealing with increases in heating costs, but the very nature of man will help get us past these problems as we all do our part in rebuilding of the gulf coast region. Challenges do test the basic character in us all, either in everyday crisis or in a broader catastrophe. How we respond says who we really are. Today we look to help the victims and find them new jobs and housing. I encourage everyone to do what they can to help people get through this and rebuild the communities struck by hurricane Katrina. This too is a way we all show the basic good in mankind...

Sincerely,

Tabeling

Joseph Tabeling, President
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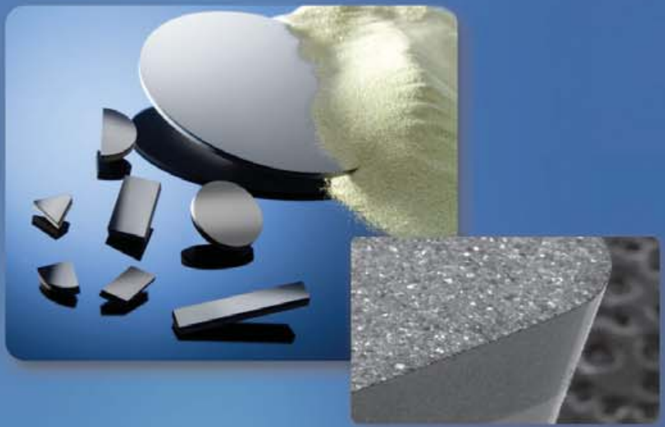

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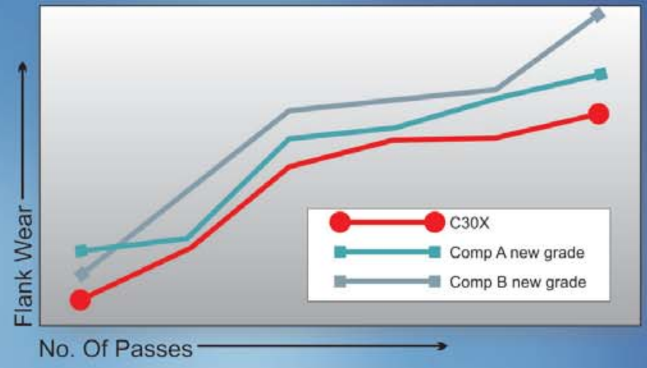

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DIAMOND *Dynamics*

By NICHOLAS TUMAVITCH, Ph.D.,
Manufacturing and Development Chemist
Warren/Amplex Superabrasives

Synthetic monocrystalline diamond (SMD) is currently used to machine and finish a wide variety of surfaces including ceramics, optics, semiconductor materials, and media storage components (photos 1a & 1b). In most cases, SMD is more than adequate to meet customer specifications for surface roughness and removal rate. However, the inherent crystal structure of SMD will eventually limit its use for next generation finishing.

Recently, abrasive manufacturers have made some fascinating morphology refinements to the base crystalline structure of sub-micron sized diamond. The incorporation of micro-crystallites, graphitic shells, and nanotechnology has greatly improved modern finishing operations. In order to match the advantages of these unique abrasive types with new state of the art finishing applications, we will present a synthetic, structural, and functional comparison to conventional monocrystalline diamond.

Photo 1a

Polished ceramic, optic, semiconductor and media storage components.

Photo 1b – *Polished Ceramic Bearings*

Features of Monocrystalline Diamond (SMD)

To understand the advantages offered by the newest generations of diamond abrasives, it is helpful to review the features of conventional monocrystalline diamond. Monocrystalline diamond is a highly ordered crystalline solid. The carbon atoms are linked together in a regular structure; each atom shares one of its outer shell electrons with four other carbon atoms in an equally spaced tetrahedral environment. To meet industry volume demands and emulate the production conditions of diamonds found in nature, diamond synthesis requires the use of high temperatures and pressures—typically around 2000 K and 60 kilobars (kb) using modern diamond presses and nickel catalysts (*figure 1*). Mechanically, presses differ slightly throughout the world; however, all SMD production falls within the shaded region of the phase diagram shown in figure 2. SMD production factories often use hundreds of presses since the reaction chamber is quite small; one synthesis might produce fewer than 100 carats to specification per run. The raw diamond must then be crushed, milled, cleaned and graded. For most finishing processes, SMD provides a good material removal rate (MRR), which increases with particle size distribution. SMD cutting edges are large in comparison to the total crystal size, sharp, and not friable. It is this toughness that enables micron and submicron SMD to retain some of the shape characteristics (such as pyramids and trigons) of the parent crystals after the crushing and milling process. SMD is resistant to acids and hot caustic solution, so the surface can be cleaned to very low impurity levels.

Schematic section through a typical belt type apparatus

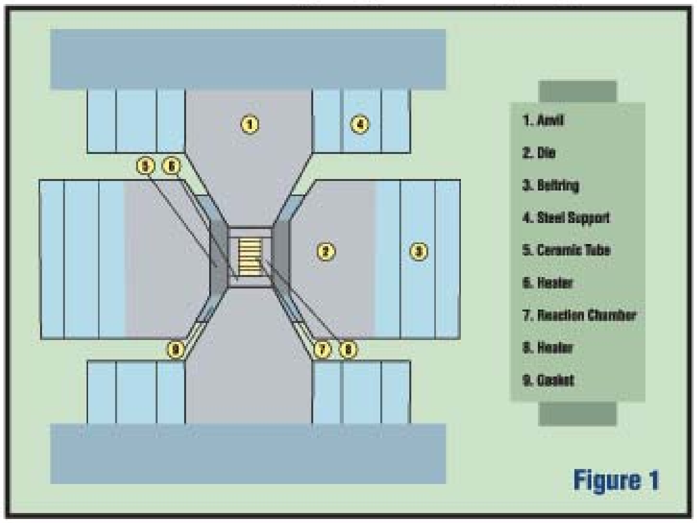


Figure 1

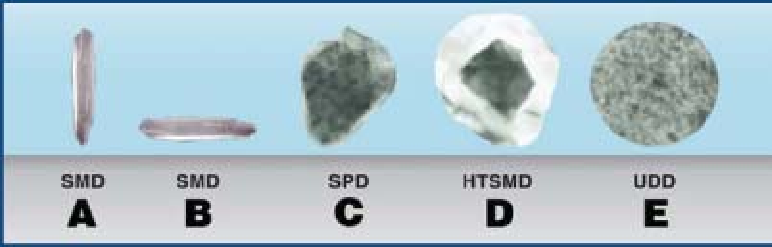


Photo 2 – *Diamond-workpiece interactions during the lapping or polishing process.*

A) SMD elongated pieces that interact perpendicularly with the surface can lead to sub-surface damage from excessive pressures at the point.

B) If the direction is parallel to the workpiece, removal rate will decrease.

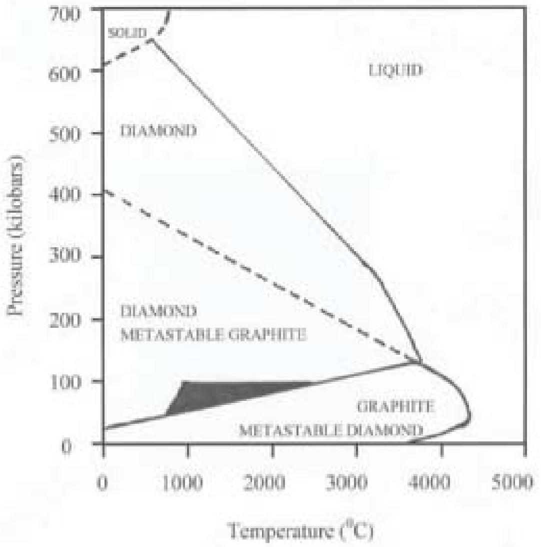
C) SPD will contact the workpiece with "microcrystallites" instead of flat planes or sharp points. The result is an increase in mrr compared to SMD.

D) HTSMD has less scratching compared to SMD since sharp points are lubricated with a graphite shell.

E) UDD does not contain any large, irregularly-shaped pieces and is used for ultra-fine finishes.

During the crushing and milling stages of micron diamond production, some elongated pieces with high aspect ratios are inherently produced from cleavage along one of the lower energy crystal planes. When the orientation of these elongated structures is perpendicular to the workpiece during finishing, subsurface damage can occur from the excessive pressure at that point. Irregular finishing patterns and lower removal rates can also occur if a plate glides horizontally across the workpiece (*photo 2a & 2b*).

Figure 2



Reducing excessive pieces with high aspect ratio in SMD feed batch presents a considerable challenge to diamond suppliers because these structures are hydrodynamically equivalent to smaller, more regularly shaped pieces. During elutriation (*photo 3*), elongated pieces gather momentum from the added frictional component and carry over into the graded batch. This phenomenon is similar to dropping two pieces of paper, one crumpled and one flat, from shoulder height to the ground. The crumpled paper will hit the ground faster

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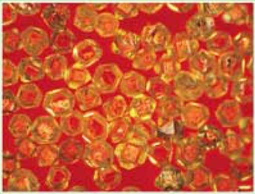

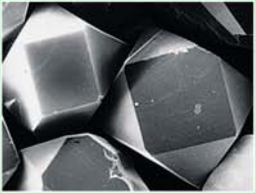

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Photo 3 – *Feeding Mircon Elutriator – used to grade – or size – the diamond*

since the frictional force of air will cause the flat paper to float. Elongated pieces can be separated in milling if the energy selected is above the cracking energy of the thin pieces and below the cleaving energy of regular-shaped pieces. The smaller fragments can then be removed in the grading process. However, extra tight distributions add significant time and cost to SMD powders.

Heat-Treated Synthetic Monocrystalline Diamond

Heat-treated synthetic monocrystalline diamond (HTSMD) is manufactured by heating well-graded and cleaned SMD in an inert atmosphere to about 1200°C. Under these conditions, the powder darkens from light gray to black (*photo 4*), which represents a reorganization of the surface into a more disordered, graphite-like layer (*photo 5*). The graphite sheets provide a lubricating region between a sharp diamond edge and the workpiece (*photo 2d*). This shell coating lowers the scratch and defect rate compared to SMD. As noted previously, elongated pieces in SMD are very difficult to remove completely from a batch since they are hydrodynamically equivalent to well-shaped pieces. However, since the entire batch of HTSMD feed is engulfed in a high-temperature oven during processing, all elongated pieces that would otherwise scratch or damage a surface are now shaped and lubricated.

The particle size distribution of HTSMD is often tighter than SMD, since unwanted pieces on the fine end tend to fuse into larger clusters or disappear completely in the heat-treating process. This property gives HTSMD a distinct advantage in the Giant Magnetoresistive (GMR) and, more importantly, in the Tunneling Magnetorestive (TMR) head lapping industry. These heads fly at less than one micro inch above the spinning, low glide disk. When other diamond forms are substituted in the lapping process, "black spots" will appear on the workpiece surface. The current theory is that the black spots are most likely pieces of diamond embedded into the surface. Since nearly all of the finer pieces are fused and lubricated, HTSMD virtually eliminates this defect. Great care must be taken when preparing dispersions of HTSMD (*photo 6*). The heat-treating process decreases the surface polarity, resulting in a tighter stability region. In fact, the heat-treated diamond must undergo a proprietary surfactant soak to add polarity to the surface; otherwise, the material will settle clear in an aqueous environment in a matter of minutes. The cost of HTSMD is considerably greater than SMD, but the benefits, can more than compensate for the price in the right application.

Photo 4 – *Color comparison between SMD (white) and HTSMD (black)*

Polycrystalline Diamond

Unlike SMD, synthetic polycrystalline diamond (SPD) is produced through shock synthesis (*figure 3*). High-energy explosives are used to generate about 250 kb (equivalent to about 3 million psi) of pressure on the graphite feed. Each SPD piece contains smaller diamond "microcrystallites." The microcrystallites are oriented in different crystallographic directions every 10-50 nm, regardless of the particle size distribution of the parent pieces. The hardness of an individual microcrystallite is comparable to that of SMD. While the difference between SPD and SMD is discernable through scanning electron microscopy (SEM), the transmission electron microscope (TEM) is required to visualize the microcrystal structure (*photo 7*). The MRR of SPD is up to 10 times higher than SMD because SPD has more cutting edges and a higher surface area (*photo 2c*). Multiple edges and corners are in contact with the workpiece simultaneously, thus reducing the probability of subsurface damage from excessive pressures. SPD also costs an average of 10 times more than SMD. However, the upfront costs can be easily recovered in the finishing operation because less diamond is required to achieve equivalent or better results, and less labor is needed due to the shorter process cycle times. For the past five years SPD has been widely and successfully used in the hard disk texture market. SPD replaced SMD during the transition into gigabyte (GB) storage technology primarily due to the significant eduction in scratch rate. Also, slurry concentration has been reduced from 10cts per liter to 1 or less. The 80GB programs will continue to use

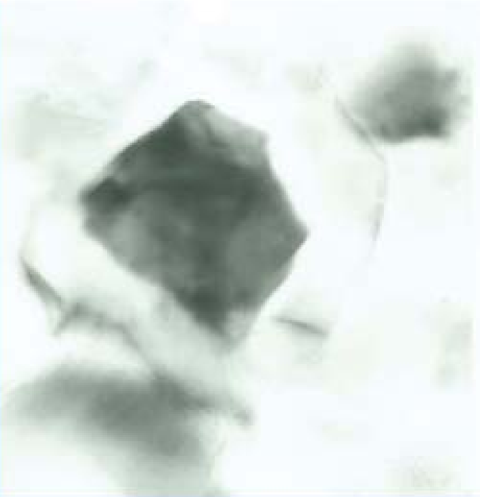
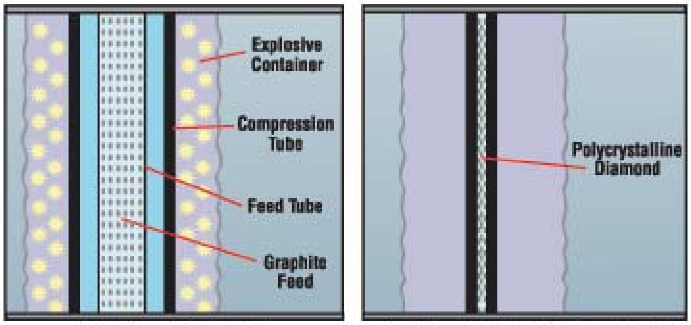


Photo 5 – *TEM image of HTSMD showing the diamond core surrounded by a graphite shell.*

Figure 3 General Features of Polycrystalline Diamond Synthesis



Reaction Chamber

Post Explosion Configuration

SPD, however, just as SMD was phased out in the GB transition, SPD will inevitably be phased out to another diamond form in the transition from 80GB to 120GB and greater.

Ultra Dispersed Diamond The Newest Type Of Nanodiamond

In recent years, the functional utility trend of diamond is increasing with decreasing particle size. Nanodiamond (defined as diamond having an average diameter of 0.100 micron or less) has more pieces per carat than traditional micron diamond used in finishing (*see Table 1*). In fact, just one carat (200 mg) of 100 nanometer (nm) diamond abrasive contains slightly over 100 trillion pieces. Since the number of pieces per carat is proportional to the cube of the radius, the quantity of 3-micron diamond equivalent to the number of pieces in 100 nm diamond jumps to 100,000 carats, or roughly 44 lbs. The equivalent mass of 30-micron diamond, a size typically used in cutting wheels, is 22 tons.

The newest type of nanodiamond, ultra dispersed diamond (UDD), contains about 100,000 trillion primary particles per carat. If we compare this number to 300-micron Bermuda beach sand at 4000 pieces per 200 mg, the equivalent mass now becomes 22 million tons (photo 8a & 8b)—enough to fill a 50-yard beach 1 ft deep with dry-packed sand 550 miles long, or roughly 14 times around the entire Bermuda perimeter. The diameter of the pieces generally falls within a 2- to 10-nm range, with the predominant size being 3-7 nm. This incredibly small size range has led to some nomenclature inconsistencies. UDD is often referred to as "nanodiamond;" however, nanodiamond is a much broader term that can also be used to identify nanosized SMD, SPD and HTSMD types. UDD is a particular class of nanodiamond. Another term related to UDD that is gaining popularity is "cluster diamond." This description is unique to UDD, as long as the terminology reflects a clustered nanodiamond and not a nanocluster diamond. The reason for the distinction is that UDD is composed of primary and secondary particles. The primary particle is the smallest identifiable unit of UDD. The surface energy

Photo 6 – *Diamond Mixing*

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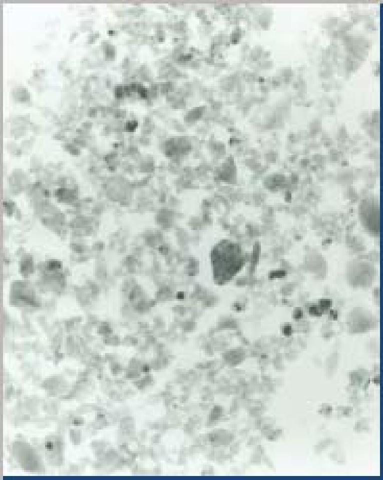


Photo 7 – *TEM of SPD showing the "microcyrstalline" structure of the parent pieces.*

of such small pieces prevents complete dispersion of UDD into a suspension or powder of primary particles. Average secondary cluster sizes used in the finishing industry currently range from 100-800nm.

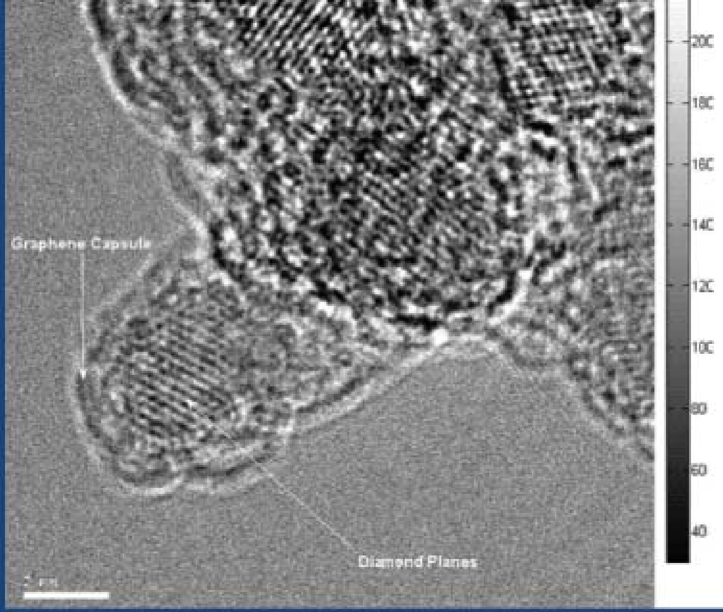


Photo 9 – *High resolution TEM image of UDD showing the diamond planes surrounded by a graphene shell.*

UDD is produced in the diamond stability region at temperatures above 3000 K and pressures above 100 kbar. However, one critical process difference distinguishes UDD from other diamond types—the feed, explosives and UDD product are contained within the explosion chamber. Both the chamber and explosives must be oxygen-deficient (<6%) to reduce unwanted byproducts and the conversion of diamond back to the more thermodynamically stable graphite. Unlike other diamond types, UDD contains many surface-functional groups, such as methyl, nitrile, COH, COOH, CO, and C_6H_6, and it is composed primarily of carbon (87%), oxygen (10%), nitrogen (2%) and hydrogen (1%). The surface groups reduce UDD density to about 2.8-3.1, although the core retains the hardness of monocrystalline diamond.

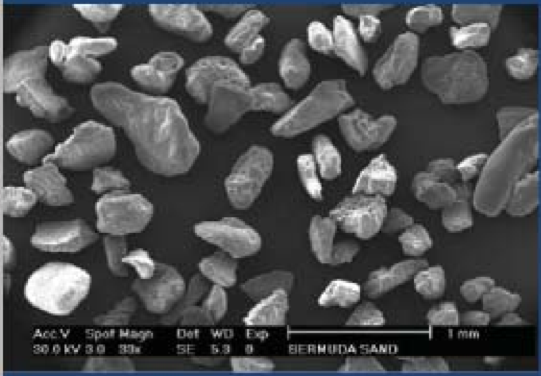
The characteristic advantage of UDD particles produced in this manner is that the edges are not subject to the attrition variability inherent in all other diamond types (*photo 9*). UDD particles are produced directly in the explosion process, unlike micron SMD that must be milled from parent pieces. Finishes are relatively scratch-free because rogue elongated pieces are not produced in the UDD manufacturing process. Initial results indicate that the MRR is relatively low, but this is expected when finishing to angstrom or sub-angstrom roughness with nanoparticles. Currently, UDD is the only diamond type used for 120GB hard disk drives and greater. Results from the data storage industry indicate that, compared to all other diamond types, UDD yields the highest disk magnetic properties and lowest scratch rates. UDD can also be used to finish glass disks and higher end optical components.

All diamond types offer advantages and challenges, and a fine line exists between optimum performance and cost effectiveness. In general, SMD is the most cost effective diamond, however, the surface finish is limited by the crystal structure. If the operator needs to increase removal rate and decrease scratch rate, HTSMD and SPD are viable options, but the cost is at least 10 times that of SMD. For ultra-fine finishes at angstrom level roughness, UDD should be the diamond of choice. ◆

Table 1 – *Nanodiamond vs. traditional micron diamond*

	One Carat 100 nm Diamond	One Carat UDD
Pieces per Carat	1.1 x 1014 5 x 1017	
Equivalent pieces 3.0 micron diamond	44 lbs	22 tons
30 micron diamond	22 tons	22,000 tons
Bermuda Beach Sand	5000 tons	22,000,000 tons

Size comparison of Bermuda beach sand with UDD. One carat of UDD contains as many primary particles as the surface of a beach 550 miles long.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30.0 kV 3.0 33x SE 5.3 0 BERMUDA SAND

Photo 8a – *Bermuda Beach Sand*

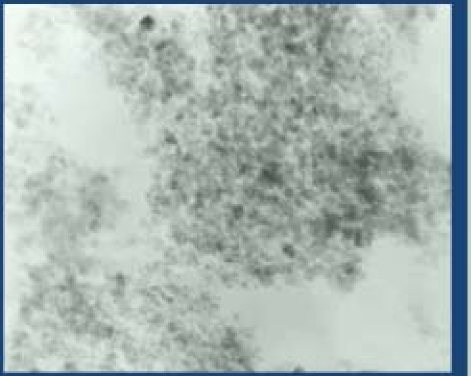

Photo 8b – *UDD*

ABOUT THE AUTHOR

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Sunnen's new SV-10 Automatic Cylinder Hone combines the latest technology with the consistency and dependability of the legendary CV-616 ... but with twice the horsepower. Incorporating two motors, one for the spindle and one for the stroker, the SV-10 has the capability to run Sunnen's new DH-series diamond hone head as well as standard Sunnen tools. The DH-series diamond hone head is the choice for producing truly round bores. It features multiple points of cutting action and covers a wide range of bore diameters starting from 2.75 in (69.9 mm). The system will handle all blocks from passenger car and high-performance engines to truck and industrial blocks up to 42 inches. And with the range of diameters on the market, from 2" to 8", the versatile SV-10 can handle any size job from single cylinder engines to big diesels. **For more information, contact Sunnen Products Company, 7910 Manchester Ave., St. Louis, Missouri, 63143. Phone: 1-800-772-2878. FAX: 314-781-2268. Web site: www.sunnen.com**

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Smithfield, Rhode Island – Safety eyewear world leader, Uvex®, has introduced a new line of Polarized Safety Eyewear for outdoor work environments. Utilizing the same top quality, polarized lenses found in high-end sunglasses, Uvex Polarized Safety Eyewear reduces glare and improves visual acuity. These lenses are perfect for industries such as construction, road work and utilities. A curved lens design provides built-in side protection to meet the requirements of ANSI Z87+ for high impact protection, and Uvex polarized lenses block 99.9% of UVA, UVB, UVC and harmful blue light. **For additional information on Uvex products, contact: Erica L. Osley, Sr. Product Manager, Email: EOsley@bacou-dalloz.com**

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Editorial

The Working Machinist

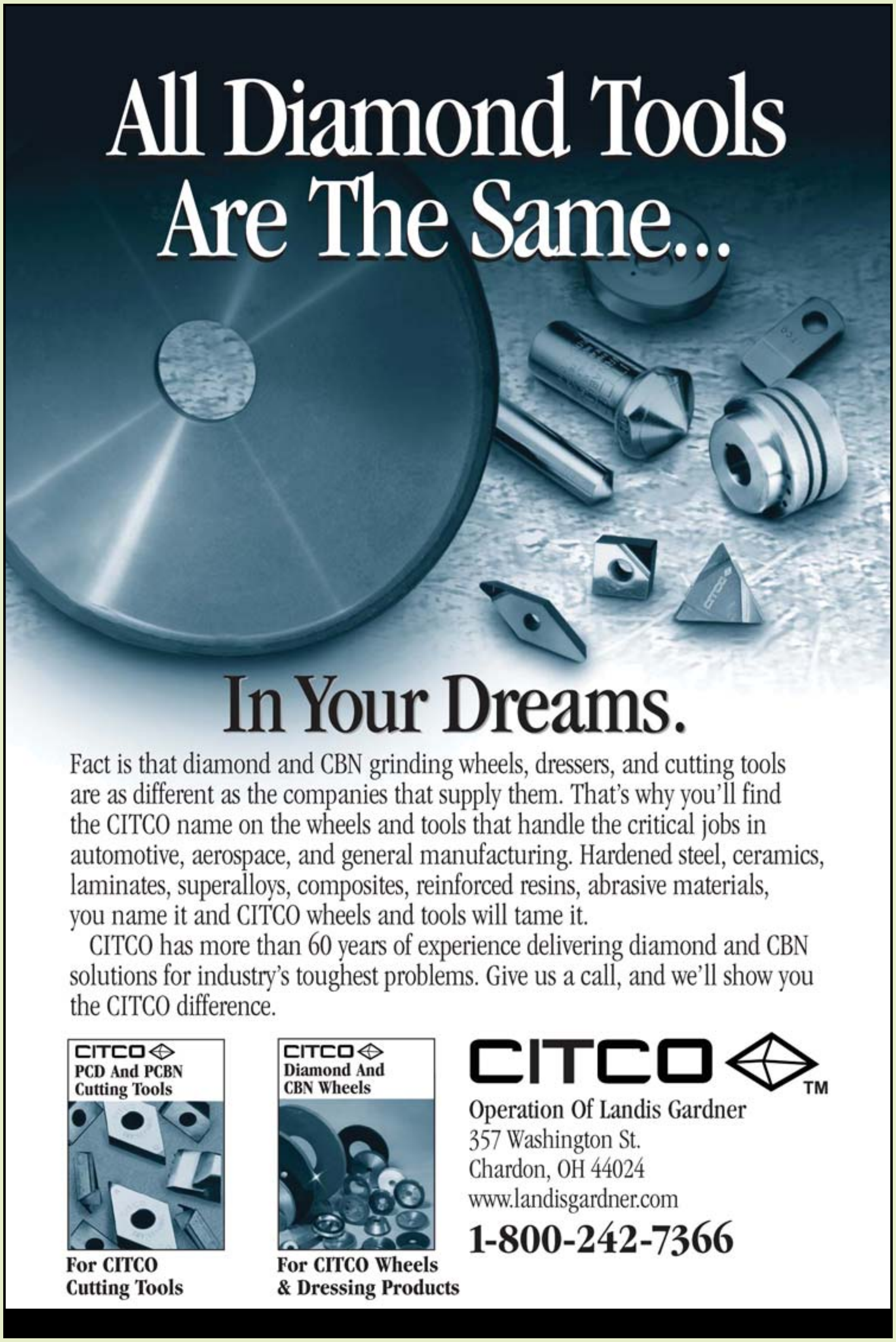
According to the U.S. Bureau of Labor Statistics, by 2011 the American workforce will experience the worst shortage of skilled workers in U.S. history. I know want they mean…

TERRY KANE, Editor

We all knew *him*… he's retired now, trading in his worn wooden toolbox for a tackle box and a fishing rod. Ah, but back in the day he was an icon of the working machinist. He always looked the same, his faded green work shirt and matching pants were his uniform and the bifocals were always perched low on his nose. He used an oil-stained scratch pad and a scarred yellow pencil to add and subtract and the grit beneath his nails spoke volumes of the hours spent in honest labor. Today we are melancholy when we speak about him and our voice becomes almost reverent as we relate the way he could craft a new component or create an instrument from a simple piece of metal. Complexity was never an issue, just tell him what you needed and he could make it. Hand him a drawing or ask him to create it from thin air, no problem. He was a salty old white-haired man with soft eyes and a stern conviction in the way things should be done. No matter what type of grinder or lathe, he was one with the machine. His skillful hands deftly interchanged the movements of handwheel cranks, using years of practical experience to combine infeed, downfeed, crossfeed and traverse to masterfully bring shape, precision and purpose from raw material. As the machine hummed a cigarette hung from his lips with a burning ember of orange and his breathing generated a continuous swirl of smoke around his head. He squinted through the smoky haze watching his work and he could tell by the very sound of abrasive against steel if he had the proper combination of speeds and feeds. Every now and then he paused and measured his work with an old micrometer, time worn with many of the increments shallow from years of use. A calloused hand across the part's surface and he quickly calculated a final pass that would bring the desired finish. His senses were the tools of his trade. Only his eyes could see the sparking wheel reflecting in the parts flawless surface and envision it's final form. The old man could feel vibration through the machines hand wheels and his keen hearing warned him of any change in the rhythmic tones of his operation.

He was a machinist who took pride in his work. Every job was a tribute to his skill and dedication. He had little concern for taking a break and his lunch may be cut short to get back to his craft or solve a problem. He was an artist, an expert and one of many whose legacy is the endearing memory he left with those who followed.

Now he is gone and the loss continues. As the Baby Boomers retire over the next six years, our economy will lose an estimated 10 million skilled workers. This shortage will create an unprecedented need for companies to not only attract and train new craftsmen, but also create a wave of interest in the trades from potential employees entering the workforce. The Industrial Diamond Association has made a concerted effort to work with organizations and develop programs that will train an incoming workforce with the skills and the dedication seen in those craftsmen of days gone by.



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INTERTECH 2006 is the Triennial International Conference dedicated to technological advancement and application development with an emphasis on increased productivity and performance using industrial diamond, cubic boron nitride, CVD diamond, polycrystallines and related materials. This conference is designed to provide a blend of commercial and technical topics and serve as a global "meeting of the minds" for technologists and business leaders.

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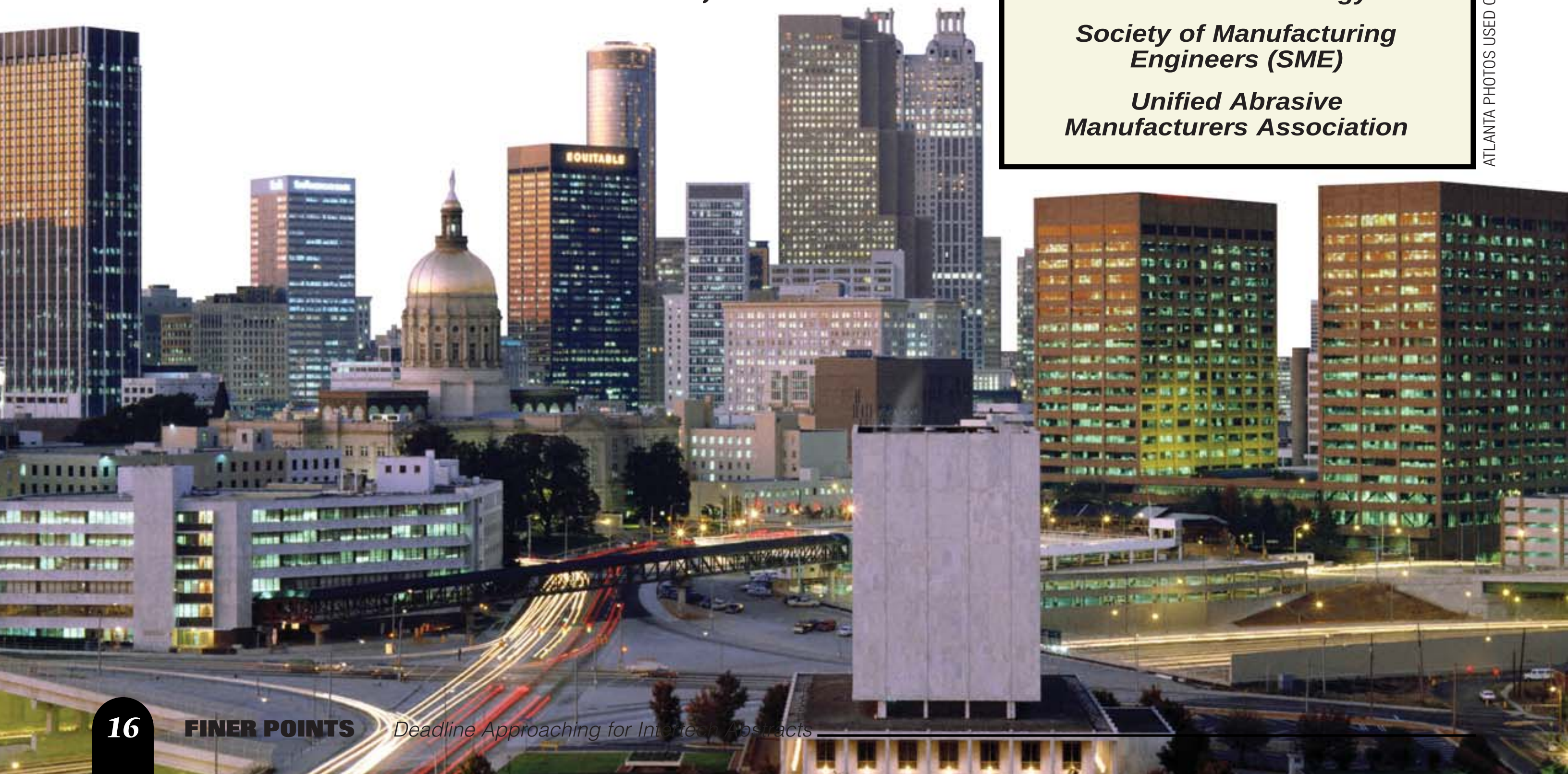

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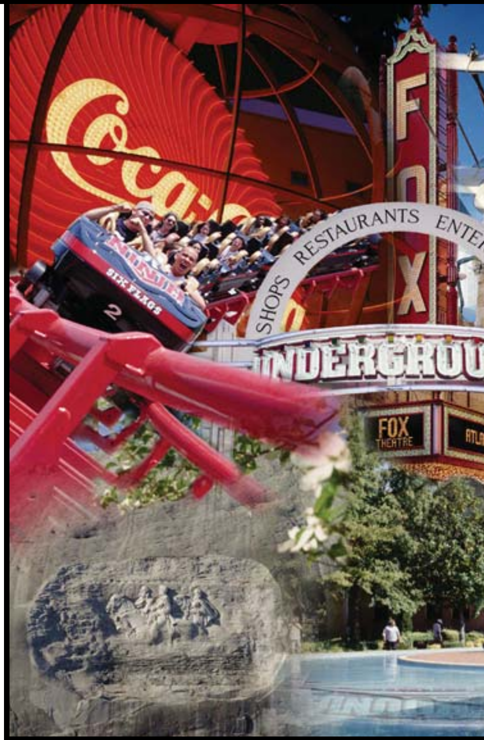

Diamond Recovery

By KEITH RECKLING, National Research

Recycling of raw materials is a "must" in today's world. Worldwide, countries and states are passing "Green" laws (photo 2) to ensure that goods are made from materials that can be re-cycled.

Photo 1

Many diamond tools can have their diamond recovered – Tool Array Courtesy of Niabraze Corporation

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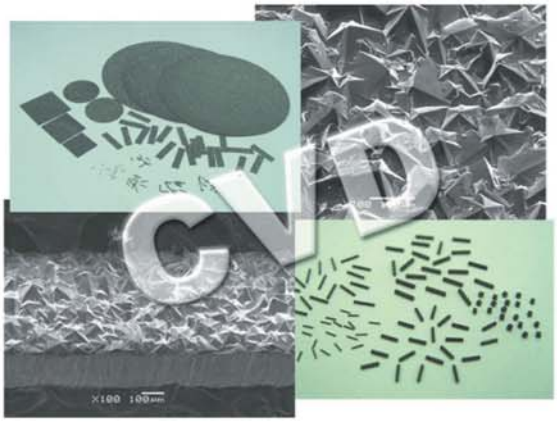

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email: tkane-ida@insight.rr.com

Sept. 19-22
Coating 2005 Show & Conference
Indianapolis, Organized by Goyer Management
www.thecoatingshow.com

Sept. 27-29
Ohio Technology Showcase
US Dept. of Energy, Ohio Dept. of Development, Energy Industries of Ohio
Cleveland, Ohio
Phone: 800-608-7141 online at
www.ohioshowcase.org

October 11, 2005
Medical & Manufacturing Design Learning Conference
Warsaw, Indiana
www.onlinetmd.com

October 20-21
Diamond At Work
1st International Industrial Diamond Conference
Barcelona, Spain
conference@diamondatwork.com

November 5
OSHA Construction Safety Training
St. Petersburg College / Clearwater, FL
727-577-5004 or visit www.csda.org

November 7-12
Operator Certification Training
St. Petersburg College / Clearwater, FL
727-577-5004 or visit www.csda.org

November 8-10
Aerospace Testing Expo
Long Beach Convention Center
Long Beach California
www.aerospacetesting-expo.com/northamerica

November 11-13
Tile & Stone Show
Las Vegas, Nevada
www.internationalstoneinstitute.com

November 13-15
UAMA Annual Fall Meeting
The Newport Marriott Hotel, Newport, RI
www.uama.org

November 13-16
FABTECH International 2005
McCormick Place South
Chicago, IL

November 29 - December 2
Sawing & Drilling 101 Training
Santa Fe Springs, CA
727-577-5004 or visit www.csda.org

2006

January 23-25
Manufacturing for Performance
Indiana Convention Center
Indianapolis, Indiana
www.sme.org/motorsports

January 28-February 1
The Concrete Sawing and Drilling Association Annual Convention
Charleston, South Carolina
727-577-5004 or visit www.csda.org

January 31
CSDA Tech Fair
Charleston Place Hotel
Charleston, SC
727-577-5004 or visit www.csda.org

February 16-17
Cutting Edge Training
St. Petersburg College
Clearwater, FL
727-577-5004 or visit www.csda.org

February 18
OSHA Construction Safety Training
St. Petersburg College
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February 20-21
Estimating Training
St. Petersburg College
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February 20-25
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March 20-23
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Photo 2 – *China is one of many countries invoking green laws due to high pollution*

Photo 3 – *Pyrophyllite blocks used as pressure transmission medium for diamond synthesis*

Photo 4 – *Reclaimed diamond is graded and sized*

Photo 5 – *Used core bits prior to diamond recovery*

Photo 6 – *Sawing concrete bridgedeck*

DEFINING THE RECOVERY PROCESS OF DIAMOND WHEN MANUFACTURED

Synthetic Diamond when produced comes out of the press as a slug of capsule and metal that consists of Capsule Material (Pyrophyllite - *photo 3*), Catalyst metal, unconverted graphite and diamond. The diamond has to be recovered by three separate processes.

1. Dissolving the capsule material (Pyrophyllite Hydrous Aluminum Silicate)
2. Dissolving the metal catalyst
3. Dissolving the unconverted graphite.

The recovered diamond is then lightly milled to separate any conglomerates, sized and graded (*photo 4*). Then classified diamond is subjected to a variety of Quality control tests.

DIAMOND RECOVERY FROM USED TOOLS

The recovery process of diamond from wheels, saws, drill bits and tools (*photo 5*) is subjected to an almost identical process. The diamond is liberated from the matrix, sized and graded and subjected to the same type of quality control tests. The recovered material has now been restored to QC Values identical to "Virgin" diamond. Diamond tool bonds contain materials that are considered toxic. If you do your own recovery or sub-contract recovery to an outside vendor, be sure your facility or your subcontractor's facility is in compliance with current E.P.A. Laws. If not, you may be liable to prosecution under E.P.A regulations.

The Industrial Diamond Industry has always re-cycled diamond. Diamond dressers and cutting tools were always re-set as were surface set drill bits and rotary dressers. Today one of the largest consumers of diamond grit is the sawing of stone and concrete (*photo 6*). We constantly hear the comment: - "New diamond costs us less than $0.60 per carat and to recover the diamond costs $0.35 per carat. It is not worth recovering so we will just throw the reject segments in the dumpster". This is a very shortsighted view.

1. It is in violation of EPA regulations and
2. It is throwing away money.

EPA REGULATIONS FOR HAZARDOUS MATERIALS

Most diamond tools, wheels and saws are made with materials that are considered hazardous materials, Cobalt, Nickel, Zinc, Tungsten and Phenolic resins. For the sake of simplicity lets focus only on diamond saw segments. Diamond segments contain Cobalt, Nickel, Tungsten and Tungsten Carbide, each one considered a toxic material. If diamond segments are found in a landfill or dump site you can be sure that EPA Investigators will eventually trace the source and the manufacturer, along with the trash hauler will be prosecuted. This can be extremely costly and can run into several million dollars for site clean up. We strongly recommend that you review the EPA regulations, which vary from state to state and consult with an Environmental Consulting Company or Environmental Lawyer familiar with the laws of your State to ensure that you are in compliance.

In summary, the EPA regulations state that materials can be stored to two ways; Containers marked " Hazardous waste" or in Containers marked "Recyclable Materials" (*photo 7*)

1. Hazardous waste - If stored as hazardous waste these containers may only be stored in a plant for 90 days and then a licensed hazardous waste hauler must dispose them of. This can be extremely expensive.
2. Recyclable Materials- EPA regulations state that these materials must be recycled within a reasonable period of time. By sending these segments to a company capable of recovering the diamond and reusing the diamond is the most cost effusive and safest way to dispose of reject or used diamond segments.

Caution! Make sure that the Company doing the recovery is properly licensed and meets state and Federal EPA standards. Sending material to an unlicensed recovery company can result in large fines and costs of dumpsite clean being levied against you.

Photo 7 – *Reclaimed or used tools containing hazardous or recycled materials must be properly labeled*

Photo 8 – *Independent tests have shown reclaimed saw diamond can perform as well as other diamond.*

Photo 9 – *Recovered Moly coated synthetic diamond*

Photo 10 – *Natural Diamond Recovered from Rotary Dressers (Reconditioned and Polished)*

ARE YOU THROWING AWAY MONEY?

Assume the diamond cost in a new segment is $0.60 per carat and the Recovery, Grading and Sizing cost is $0.35 per carat. A typical segment is 2″ x 3/16″ x 1/4″ and has a volume of 0.094 cubic inches. At 25 concentration or 18 carats per cubic inch at $0.60 per carats, the segment contains 1.69 carats or a diamond value of $1.01. From a production batch some segments are rejected. This is the point at which it appears some saw segment manufacturers view costs incorrectly. We are constantly receiving the comment: "If we have to pay $0.35 to recover the grit, our diamond now costs $0.95 per carat. This is incorrect if one follows standard cost accounting practices. Reject segments should be valued at zero and the real manufacturing cost of the approved segments should include the cost of the reject segments. In effect, by recovering the diamond at a cost of $0.35 per carat, material is now suitable for recycling with a saving of $0.25 per when compared to new diamond. Let's say a company produces 10,000 segments per month and has a reject rate of 2% or 200 segments. With a diamond content of 1.06 carats per segment and an 80% recovery then there is a recovery of .84 carats + Scrap or 168 carats at $0.25 = a recovery savings of $42.00 per 200 segments.

RECOVERED DIAMOND PERFORMANCE

The question that most saw segment manufacturers have is, can they reuse recovered diamond safely without jeopardizing the performance of their saw blades (photo 8)? The answer is yes, provided the recovered diamond it is properly sized and graded as part of the recovery process. The chemical recovery process has no effect on the diamond. There is a perception that the sintering process weakens synthetic diamond and recovered diamond is therefore scrap and should not be reused as new diamond… This is a misconception. All synthetic diamond contains a small amount of catalyst metal inclusions in the form of tiny metal platelets trapped in the diamond during the conversion from graphite to diamond. On heating, these platelets expand causing a reduction of impact strength by 6-12% (A metal coating process on new diamond grit reduces impact strength by ±5%). Assume a good quality diamond prior to sintering has a strength index of 90% and is weakened 8% by sintering to 82%. A new segment, which that has passed all QC standards, is presenting diamond to the work piece that has a strength of 82% not 90% (natural crushed diamond has a value of ± 45%). When the diamond is recovered and properly graded the top quality recovered material will have strength of 82%. Sawing tests using 100% recovered and properly graded diamond have shown no drop in performance, since the diamond does not appear to weaken further with a second or third recycle. In several instances tests with recovered material have shown increased performance most likely due to the diamond crystals now being more uniform because marginal crystals have been removed in the recovery and grading process.

OTHER PRODUCTS THAT CONTAIN DIAMOND SUITABLE FOR RECYCLING

In addition to the aforementioned saw diamond here is a sample list of tools that are sources of material for re-cycling (*photos 9-13*):

Dressers
Turning Tools
Mining Bits
Oil Well Bits
Rotary Dressers
Metal Bond Wheels
Saw Segments
Bit Segments
Vitrified Wheels
Plated Wheels
Plating Tanks

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Photo 11 – *Reclaimed saw diamond*

Photo 12 – *Reclaimed cbn*

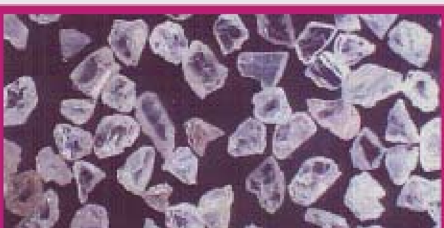

Photo 13 – *Natural diamond from Plating Baths*

Also, Cubic Boron Nitride grit can be recovered from Vitrified, Plated and Metal Bond wheels.

St. Gobain/Norton Abrasives has a program called "Full Circle Abrasives Recycling" and can be found on their website search at www.ind.nortonabrasives.com To quote the St. Gobain program:

"THE LESS LANDFILL THE BETTER

From an ecological point of view, protecting our environment is a sound policy. Most corporations are realizing it makes for sound economic policy as well. The national plan for cleaning up hazardous waste sites - Superfund - has already cost corporations and the Environmental Protection Agency (EPA) $9 billion. The EPA estimates the total tab to clean up 1,222 sites on its National Priority List will reach $40 billion. Many of these sites were contaminated before the dangers of pollution were fully understood and before it was declared improper to dump certain materials. This no longer serves as an excuse. Today, federal laws maintain that a company may be held responsible for cleaning up a hazardous waste site if it owns or manages the property, or is responsible for the generation, transport or storage of such material, currently or in times past.

YOU COULD END UP PAYING FOR ANOTHER COMPANY'S POLLUTION

Under the Superfund law; liability is "joint and several." So if one party is unable to pay its share of clean-up costs, the EPA can recover the remaining funds from those capable of paying… even though they may have contributed very little to the problem. The "deep pockets" syndrome can be painful, with clean-up costs for a typical hazardous waste site averaging $30 million. And that doesn't even take into account the impact of negative publicity on stock prices, brand names, employee morale, and community standing. These are compelling reasons to be careful of how you dispose of materials - even those considered harmless now. In the future, they may be reclassified and deemed hazardous. As for landfills, they're being phased out of the picture as an alternative. According to the EPA, 80 percent of the landfills in the U.S.A. will close in the next 18 years. Meanwhile, disposal costs will continue to escalate at available sites. How can a concerned company dispose of materials left over from the manufacturing process in a responsible manner?" **Be Smart. It takes years of hard work to build a successful company. Don't put all your hard work at risk by ignoring EPA regulations Recycling is safe, economical and just makes sense.** ◆

Be Smart. It takes years of hard work to build a successful company. Don't put all your hard work at risk by ignoring EPA regulations. Recycling is safe, economical and just makes sense.

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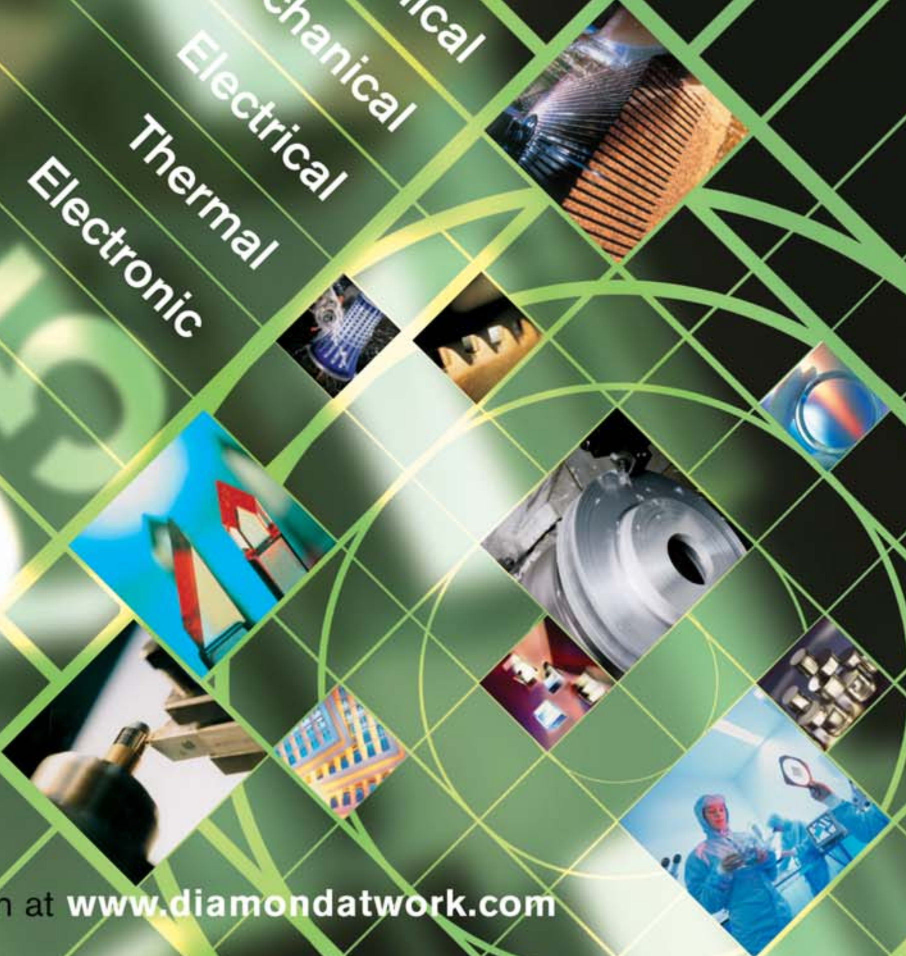


More information at **www.diamondatwork.com**

NEWS and notes

abrasive technology

ABRASIVE TECHNOLOGY APPOINTS DAN HERZOG SALES AND BUSINESS DEVELOPMENT PROCESS ENGINEER TO THE LEADERSHIP CENTER OF EXCELLENCE

Dan has more than 30 years of domestic and international experience in manufacturing, marketing and sales of superabrasive grinding wheels and tools. He most recently served as President of Wendt U.S.A. Inc., having joined Wendt in 1986 as General Manager. Dan holds a Bachelor of Science degree in Mechanical Engineering from the University of Kentucky and a Masters of Business Administration degree from Xavier University. Prior to joining Wendt, Herzog had a 14-year career with GE Superabrasives, where he was Manager, Sales Europe; Manager, Sales Pacific; and Market Development Engineer. Herzog is a past president of the IDA (Industrial Diamond Association) and former two-term president of the UAMA (Unified Abrasive Manufacturers' Association). "Abrasive Technology is pleased to welcome someone of Dan's depth of experience and knowledge to our team," said Loyal M. Peterman, Jr., Abrasive Technology Founder and President. "Dan is recognized throughout the world as a well respected industry leader. With the addition of his leadership skills, we will continue to further solidify our position as the worldwide leader in superabrasive grinding and tooling."

SUMITOMO ELECTRIC

SUMITOMO ELECTRIC IS PLEASED TO ANNOUNCE ON AUGUST 1, 2005, AARON NOLAN WAS HIRED BY SUMITOMO ELECTRIC CARBIDE, INC.- DIAMOND GROUP AS A SALES ENGINEER.

Aaron graduated from Capital University in Columbus, Ohio in May with dual degrees. His degree in Mathematics focuses on business and statistical analysis. His degree in Economics focuses on both domestic and international economic relations as well as some forecasting/modeling. As a Sales Engineer Aaron will be responsible for marketing new products, developing new accounts and servicing present customers. He will be handling sales of PCBN, PCD, and single crystal diamond products. Aaron is 22 years old, resides in Dublin, Ohio and enjoys all forms of sports.

SST

SINGLE SOURCE TECHNOLOGIES TEAMS WITH JAPANESE TECHNOLOGY MANUFACTURER TO HOST THREE-DAY MOLD & DIE INDUSTRY EXPO

Auburn Hills, Michigan – Single Source Technologies, Inc. (SST) – a sales, service and application-based organization specializing in machine tool products used in niche-type metal cutting industries – will team with Makino Die/Mold Technologies to host the "Built for Die/Mold" Technology Expo 2005 at SST's Tech Center in Auburn Hills, Michigan on October 4-6, 2005. For more information or to register those interested can contact (248) 232-6200

SME Society of Manufacturing Engineers

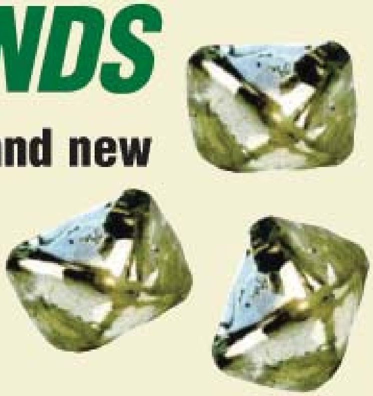
The Industrial Diamond Association of America and The Society of Manufacturing Engineers have announced a cooperative effort to expand training programs with a stronger emphasis on superabrasives. The two leading organizations are currently cosponsoring INTERTECH 2006. Dr. Stuart C. Salmon, Chairman of the Machining and Material Removal Community, Rodney G. Grover, Community Relations Manager, Machining & Material Removal and Terry Kane Executive Director for The Industrial Diamond Association of America finalized the agreement for completion of a certificate course in 2006.

NANO-PROPRIETARY, INC. TO EXHIBIT BREAKTHROUGH TECHNOLOGIES AT NANOEUROPE 2005

NP nano-proprietary, inc.

Austin, Texas – Nano-Proprietary, Inc., through its wholly owned subsidiary Applied Nanotech, Inc. is unveiling several new technologies during NanoEurope 2005 at the Swiss Fair Center of Olma Messen St.Gallen in Switzerland. The company plans to launch newly introduced technologies, such as thin nanocolumnar film coated on a flexible cloth that composes pollutants at the molecular level in gases and liquids by the photocatalytic effect; and NanoShooter(tm), which is suitable for implantation and surface modification of nanomaterials deposited on other surfaces, such as silicon wafers, glass substrates, ceramic sheets, carbon plates, metallic films, etc. Nano-Proprietary's website is www.nano-proprietary.com

NATURAL INDUSTRIAL DIAMONDS



For traditional and new applications.

By STEVE ROFFMAN
Lieber & Solow, Co.
New York, NY U.S.A.

Natural diamonds are the superabrasive product of choice for many traditional diamond tool applications, and the only choice in certain new critical and specialized applications.

What is most interesting is the positive effect on the end user when deciding to use natural diamond for their superabrasive applications.

A RENEWED INTEREST IN NATURAL DIAMOND TOOLING

During the last few years, users of superabrasives have seen continuous and renewed interest in natural diamond tooling. New, specialized applications for natural diamonds have evolved out of the need to cut specialized products, where alternatives simply cannot do the job. There are new cutting applications using diamonds to focus other cutting materials, such as jet streams of liquids. Additionally, many of the traditional superabrasive applications for natural whole stones, natural mesh and natural micron powders continue to find natural diamond as the best choice of material for specific applications. The development and marketing of natural diamond products is a specialized, sophisticated and challenging business. Research and Development of diamond products leads toolmakers to work with end users to design tooling that best meets the criteria for specific applications.

And the diamond supplier's work closely with the toolmakers to find the appropriate geometry and quality of diamond needed to produce the most effective and efficient tooling possible while still maintaining price flexibility. Since the late 1950's, synthetic diamonds and diamond like products have fueled the growth of the superabrasive marketplace. Still, the demand for natural diamonds remains stable. Upwards of 50 million carats of natural diamonds are used in industry every year. With so many alternatives available, how does natural diamond tooling remain such an important and viable product in today's modern industries? While many of the diamond tool manufacturers found opportunity in change, and moved to the new synthetic diamond products, some companies specialized in natural diamond tooling and continue to thrive by capitalizing on individual niche markets and the development of "specialized" products. These "boutique" shops lead the way for the creative application of natural diamond products. Companies, both large and small, continue to invest in the research and development of natural diamond products leading toolmakers to work with end users to design natural diamond tooling best fit to meet specific criteria for the specific applications.

NATURAL DIAMOND TOOLING

Diamond Dressing Tools

Natural Diamonds are the most effective and efficient material for the dressing of conventional grinding wheels. This is primarily true because of the formation of natural diamond and the vast range of qualities available. The octahedron and dodecahedral structure of natural diamond, with the closed edges that come together to form strong points are essential for single point dressing applications. Each diamond, because of its natural geometry, can have as many as six usable points. Users can opt for a range of tools from single use tools, with a stone having only one useable point, to tools with stones which can be re-set to use all 6 of the available points.

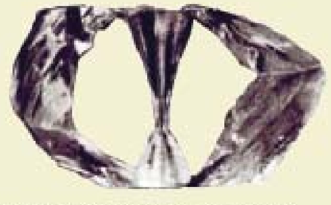
Form Tools For Truing and Dressing Applications

Form dressers are designed for truing and dressing formed grinding wheels. The tolerances of the tool are critical to obtain good manufacturing processes. Ultra fine, clean diamonds are selected and polished by skilled diamond cutters to precise tolerances for the most critical applications. Medium quality diamonds may be chosen and cut to acceptable tolerances when the design calls for less stringent specifications yet requiring a tool that stands up under high production conditions. Lower quality diamonds are called for in the design of typical, utility type tools. In these situations, cost of the stone may be the overriding factor; however, the requirements of a superabrasive tool can still be met with a quality product when the diamond form, size and quality are correctly matched to the application.

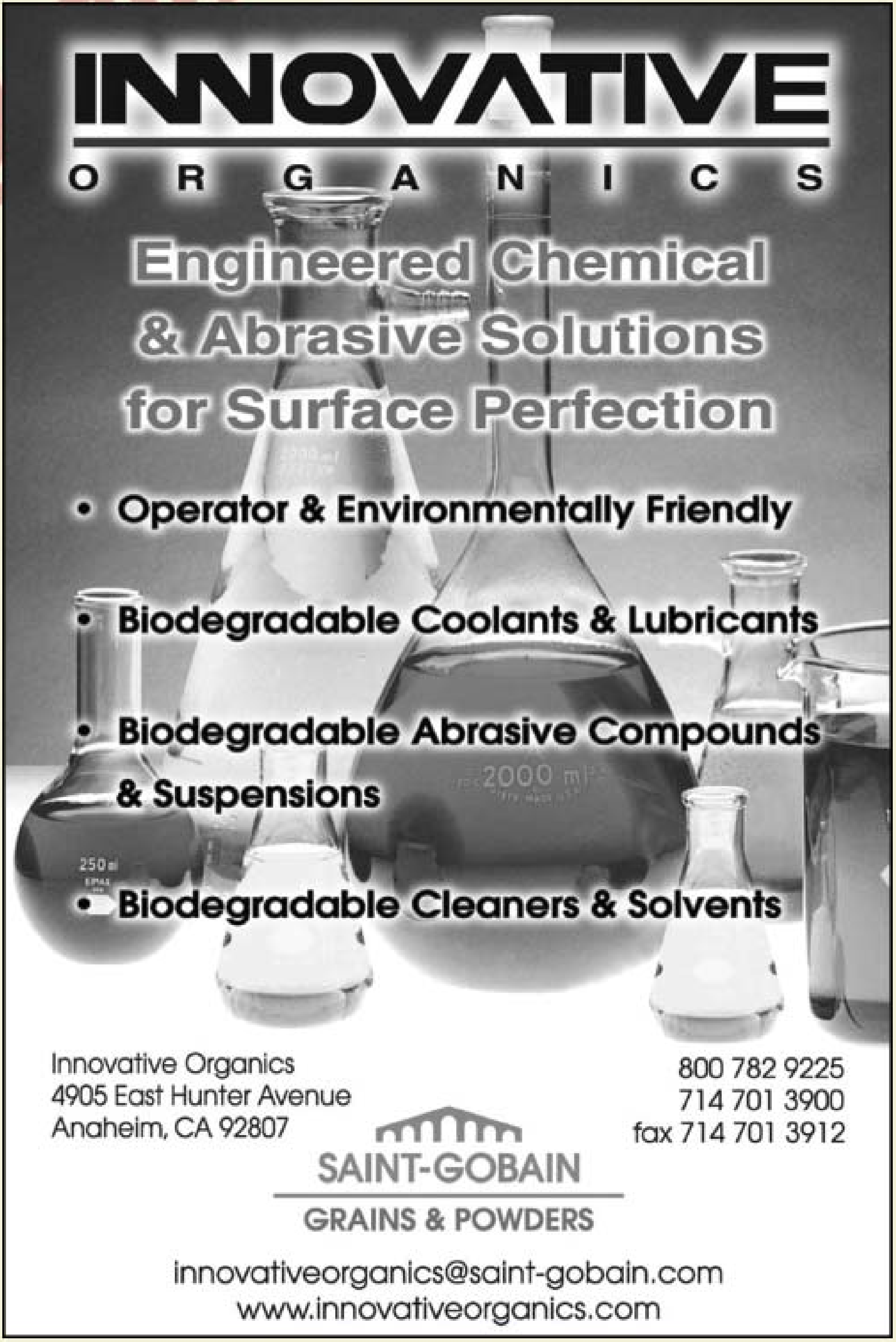
Shape Tools for Cutting Applications

End users still find a broad range of applications where natural diamond is the optimum product. The available range of quality, size, shape, thickness and other characteristics found in natural diamonds gives great flexibility and choice to the end user and the tool designer. The finished cutting edges of PCD, PCBN and CVD products are inherently limited by the fact that they are multi particle products. CVD products have, so far, also been limited in their maximum thickness as well as limited by problems with adherence to the substrate. Both natural diamonds and single crystal synthetics are used where high magnification, chip free cutting edges are required. Yet the use of single crystal synthetics may sometimes be questionable, as many end users have determined that tool life may be inconsistent and that natural diamond, under similar conditions, will outperform single crystal synthetics. The "one quality, one price" of synthetics tends to limit the end users choice. Again, we can see that in many applications, natural diamond is the product of choice.

Diamond Dies for Drawing Wire



For applications of drawing non-ferrous metals that require ultra fine finishes, diamonds are used as the cutting, or drawing material. In particular, in today's high tech world, ultra fine wires are required in enormous quantities and the demand for natural diamond dies has exceeded the expectations of many. Many believed that the advent of PCD and single crystal synthetics would eliminate the demand for natural diamond. Although single crystal synthetics have been on the



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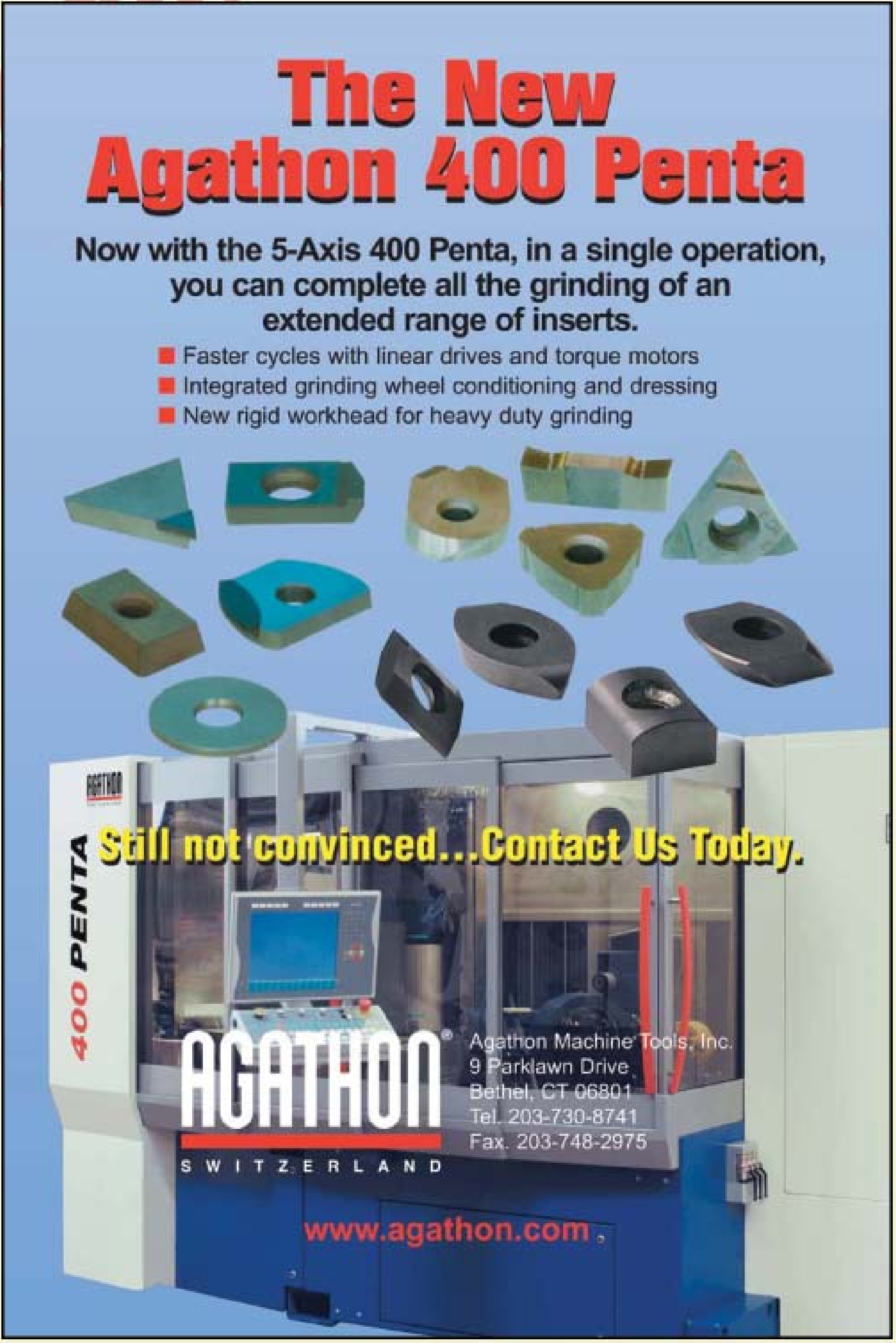
market for a few years now, and have entered some niche markets, producers, end users and suppliers continue to have strong demand for natural diamond dies. PCD has helped to expand the market for diamond dies replacing carbide dies for larger sizes and improving productivity dramatically. The continuing demand for natural diamond stones can be directly related to better performance from naturals plus flexibility in pricing and sizing that naturals provide. For obtaining high finish and for drawing fine sizes, natural diamond continues to be the material of choice offering the highest quality with the greatest productivity.

Diamond Drill Bits

Diamond drill bits are used in mineral and oil exploration, mining, and construction. This is clearly an area where alternative products and techniques have heavily impacted the usage of natural diamonds; however, natural diamonds continue to be used, although at a lower level of consumption and price than in the days before alternative products were available. The availability of inexpensive natural diamonds allows bit manufacturers to exploit the potential of naturals by using either natural exclusively or mixed with synthetic products. Thus, manufacturers can produce bits that increase the efficiency of the drilling process and natural diamonds are still an important part of the process in many applications.

Grinding Wheels, Rotary Dressers, Impregnated Tooling

This group of tools is used in many types of engineering applications. Natural diamond is often the raw material of choice when manufacturing various types of impregnated tooling used in dresser applications. The strength of the natural crystal and the cutting and friability properties of natural diamond, provide the best characteristics in many of these applications. Consequently, in manufacturing rotary dressers, natural diamonds, both processed and unprocessed, are the main material used. Where additional strength is required, such as in critical sections of the rotary dresser, natural diamond crystals are used to give added strength to the wheels. Natural diamond powders are used to obtain ultra fine finishes and for fine grinding. The producers of these natural materials process, crush, categorize and size each product into the many grades that are used in today's superabrasive industry.



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Industrial Diamond Association of America, Inc.

MEMBERSHIP APPLICATION

Company ______________________ Address ______________________

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Shipping Address (Can not ship to PO Box) ______________________

City ______________________ State ______ Zip Code/Postal Code ____________ Country ______________________

Phone ______________________ Fax ______________________

E-mail ______________________ Web Site ______________________

Official Representative ______________________

Others (Participating in IDA Activities) ______________________

Principle Business Activity ______________________

Which applies to your company: ______ Corporation ______ Partnership ______ Sole Proprietorship

Provide names of principle officers or partners: ______________________

When was your company established? __________

How long has your company been engaged in superabrasive/ultra-hard material industry? _______

List at least two business references, preferably one is an IDA member (name, company and address of each):

1. ______________________

2. ______________________

CHECK APPROPRIATE MEMBERSHIP

______ **Regular Membership**

Any company and/or individual classified as a superabrasive/ultra-hard material supplier, tool maker, machine tool builder, end user or related business with offices in the USA, Canada or Mexico is eligible in this category. Only one individual shall be designated by each member company as the IDA Delegate with voting and other privileges described in the By-Laws.

(DUES CATEGORY)

The dues category for Regular Members is determined by annual sales volume expressed in US $ as indicated below.

Check to appropriate category:

_____	Category 1	$2,500 per year	Over $20,000,000 Annual Sales
_____	Category 2	$1,880 per year	$10,000,000 - $19,999,999 Annual Sales
_____	Category 3	$1,660 per year	$6,000,000 - $9,999,999 Annual Sales
_____	Category 4	$1,290 per year	Under $2,000,000 - $5,999,999 Annual Sales
_____	Category 5	$770 per year	Under $1,999,999 Annual Sales

Name of Delegate Voting Member: ______________________

Title: ______________ E-Mail: ______________

______ **International Membership**

Any company and/or individual classified as a superabrasive/ultra-hard material supplier, tool maker, machine tool builder, end user or related business which does not have offices or other facilities in the USA, Canada or Mexico is eligible in this category. An International Member shall have all the privileges of regular membership, except that the delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for International Member is **$2,000 per year**.

Name of Delegate Voting Member: ______________________

Title: ______________ E-Mail: ______________

______ **Associate Membership**

Available for companies having a principal office in the USA, Canada or Mexico, which are providing products or services to the superabrasive/ultra-hard material industry, but are not engaged in selling, using or dealing in industrial diamonds, cubic boron nitride, compacted diamond/cbn, diamond film or products containing diamonds/cbn. An Associate Member shall have all the privileges of regular membership, except that the delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for Associate Member is **$500 per year**.

Name of Delegate Voting Member: ______________________

Title: ______________ E-Mail: ______________

______ **Affiliate Membership**

Each company that enrolls as a Regular or International IDA Member is entitled to have a second person at that company designated an Affiliate Member. The first Affiliate member will receive IDA material at no further cost. Additional persons at Member companies can be added as Affiliate Members to receive IDA materials. Annual fee for Affiliate Member is **$75 per year**.

Name of 1st Affiliate Member (no charge): ______________________

Name of 2nd Affiliate Member ($75): ______________________

Name of 3rd Affiliate Member ($75): ______________________

If more than 3 Affiliate Members, please attach separate sheet.

______ **Education/Research**

Any individual having an affiliation with a non-profit educational institution or Research & Development organization is eligible for membership in this category. An Education/Research Member shall have all the privileges of regular membership, except that the delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for Education Member is **$125 per year**.

______ **Senior Membership**

Available for any individual who has retired or is no longer active in the diamond or cbn business, but wishes to receive information mailings and attend IDA meetings as a member. Annual fee for Senior Member is **$50 per year**.

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Specialized Applications of Natural Industrial Diamonds

Diamonds are intrinsic to the manufacture of certain types of high precision tools and knives. The single crystal continuous structure, combined with the purity, stability, strength and integrity of natural diamond provides the best possible choice of material for use in new and evolving technology. Diamond knives are used in surgical procedures and for slicing and sampling of various materials, including human tissue. Diamond nozzles are used in water jets for specialized cutting applications. In high-tech industries such as the manufacture of fiber optic lines as well as certain precise etching applications, no other material has the repeatable characteristics of natural diamonds. Heat sinks, specialized diamond windows, guides, hardness testers, and ultra precision cutting tools are but a few more of the specialized applications where natural diamonds excel.

End-User Has Full Range Of Options To Best Fit Their Requirements

As more attention and thought is applied to natural diamonds for use in industry, tool manufacturers extend and increase the range of tools made with natural diamonds. This ensures the end-user a full range of options to best fit their requirements. The toolmakers do this knowing they have the support and commitment of diamond suppliers who are dedicated and understand the requirements of this unique and important industry. A modern, efficient and responsible rough diamond trade ensures the availability of natural industrial diamonds. It may take a million years to form a diamond, but a natural diamond is a modern product for building the future. Together, the toolmakers and their suppliers combine to create better products, economically and responsibly. ◆

CHECKLIST *of things to do...*

FINER POINTS

☐ Renew my subscription to Finer Points magazine.

☐ Reserve my ad space in the next Finer Points issue.

☐ Submit article for consideration in future issue of Finer Points.

☐ Send Finer Points my business news, new products, new hires, promotions, industry news and other press release items.

☐ Pass this issue around to a friend.

☐ Send in my membership application to the IDA.

☐ Refer a company to IDA for consideration as a member.

☐ Visit the IDA Website at: www.superabrasives.org and submit a question or comment.

☐ Contact an IDA member for products or services.

☐ Mark my calendar to attend Intertech 2006, April 24-26, 2006 in Atlanta.

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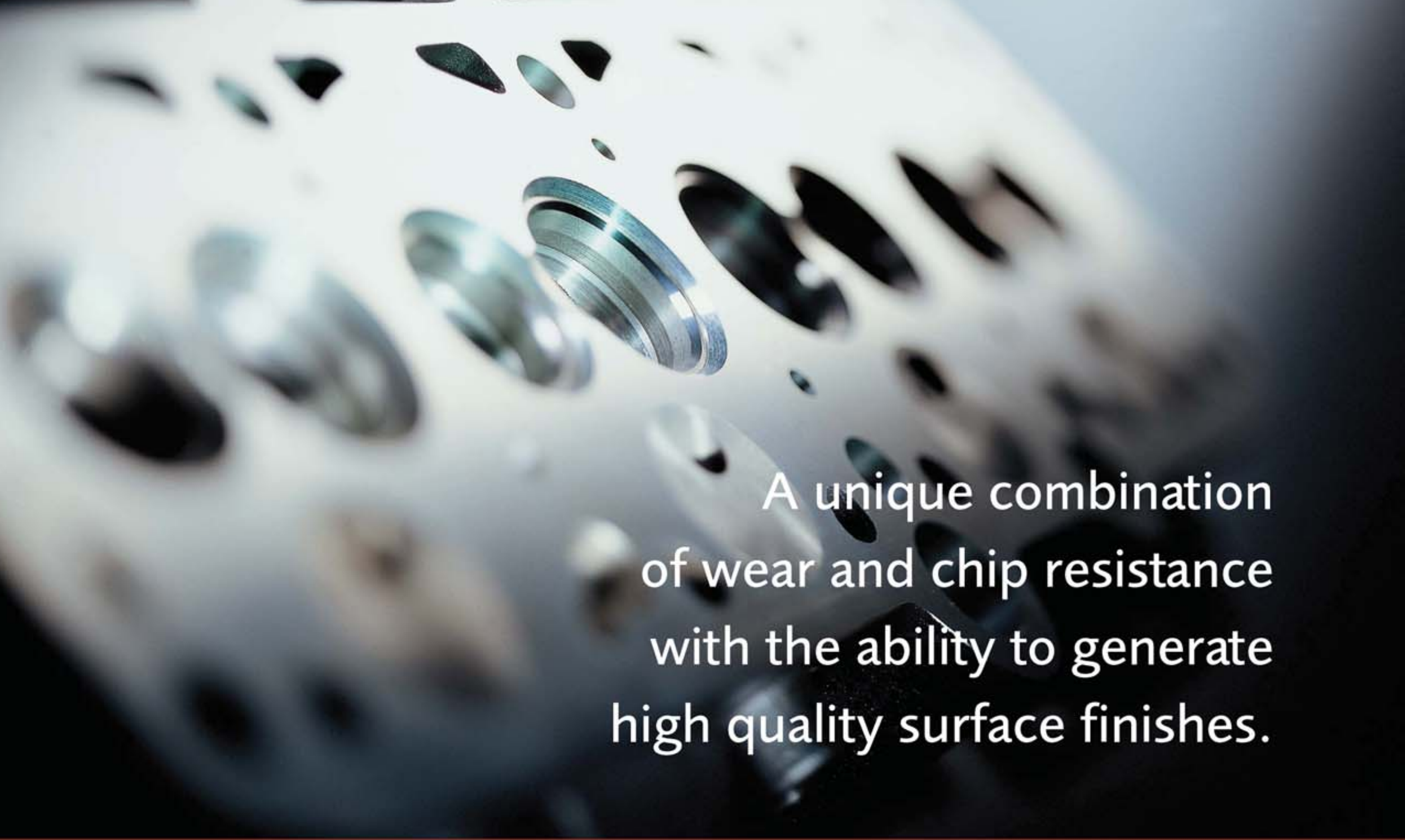

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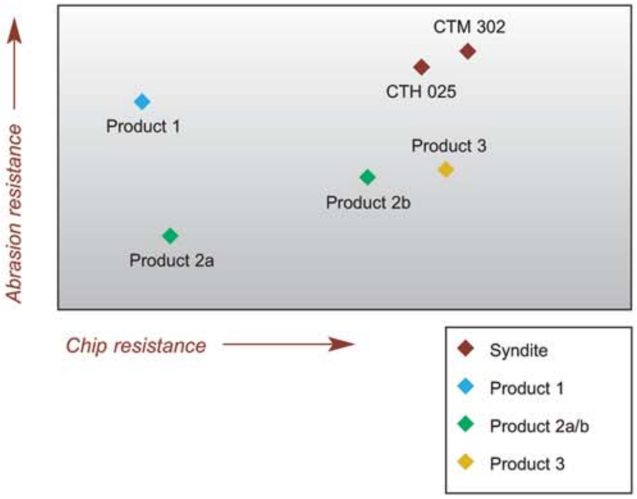

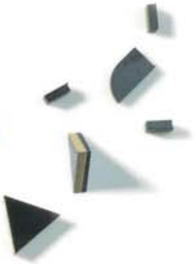

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